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Seed Treatments for Cotton

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SEED TREATMENTS FOR COTTON[1]

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Is there any value in treating planting seed of cotton? What does the treatment accomplish? How general is the practice? What material is used? How is it applied to the seed? How much does seed treatment cost?

These and other questions on cottonseed treatment are in the minds of many Southwestern cotton growers as the planting season approaches, and it is the purpose of this article to provide the latest available information in answer to these questions.

WHAT ARE OUR NEIGHBORS DOING? Knowledge of seed treatments for cotton dates back several decades, based on the results of experiment station tests in many of the cotton states. But it was not until 1936 that an intensive program of extension teaching brought the practice of cottonseed treatment to its present extensive usage. The widespread and rapid adoption of cottonseed treatments is brought out in the following figures:[2]

In North Carolina seed treatment got underway in 1935 with 7,000 acres planted with treated seed. The next year the acreage jumped to 24,000, the next 200,000, the next 450,000, and last year 600,000 acres—nearly all of North Carolina's cotton acreage—was planted with treated seed.

In South Carolina the results were similar. Starting with about 4,000 acres from treated seed in 1935 the acreage stepped up each year until in 1939 there were over one-half million acres from treated seed.

In Georgia it was estimated that about 20,000 acres were planted with treated seed in 1936, 80,000 in 1937, and 160,000 in 1938.

In 1939, 90 percent of all cotton growers in Virginia treated their cottonseed.

While figures are not available from the other cotton states, it is known that extensive adoption of seed treatment prevails throughout the Belt.

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[1] Originally published in *The Cotton and Cotton Oil Press*, March 16, 1940.

[2] R. J. Haskell, Sr., plant pathologist, U. S. Department of Agriculture, in a paper read before the Association of Southern Agricultural Workers, February 7, 1940.

How can we account for this phenomenal adoption of seed treatment? Again the figures tell the story. Farmers will adopt a new practice only if they can see a substantial return on the investment. In North Carolina the acres from treated seed have shown an increased value of cotton compared with untreated acres varying from $13.05 per acre in 1936 to $2.96 in in 1939, with an average gain of $9.82 per acre for the past four years. This represents a total benefit to North Carolina growers of $11,830,000. The profit from the treatment in South Carolina has been estimated at $2,000,000 for two years. In Georgia the farmers using treated seed reported an average gain in stand of 36 percent in 1930, 46 percent in 1937, and 41 percent in 1938. The results from Virginia show an increased yield of 28 percent in treated acres which represents a profit of $11.95 per acre. One authoritative opinion ranks cottonseed treatment with hybrid corn as a recent technological development in agriculture.

Can we expect similar benefits in the Southwest? Due to climatic conditions in Oklahoma and Texas, the benefits from seed treatment are not quite as pronounced as in the more Eastern parts of the Cotton Belt. One of the important reasons for seed treatment is to protect cotton from the anthracnose disease, which rarely is serious west of Arkansas and Louisiana. However, the field tests which have been conducted by the Texas and Oklahoma Experiment Stations during recent years, show that there is a substantial profit to be expected from seed treatment in the Southwest, a profit which far exceeds the cost of the treatment. Some growers look on seed treatment as a low cost insurance against stand failures in those seasons in which the planting is followed by cold, wet weather. Since treated seed consistently gives a better rate of emergence than untreated seed, there is a saving in the amount of seed which must be planted, together with the production of stronger plants.

Why should cottonseed be treated? Cotton is subject to a number of contagious diseases caused by parasitic fungi and bacteria, which attack the roots, leaves, bolls, and lint. Chief among these are bacterial blight or angular leaf spot, anthracnose, leaf spots, root rots, and boll rots. The same organisms which cause these diseases of the mature cotton plant are also able to attack cotton seedlings at a very early stage, rotting the seed in the soil, killing the seedlings before they break through the ground, or causing the emerged seedlings to decay at the soil line and collapse.

After the crop has been harvested, some of these parasitic organisms survive the winter in the soil, while others lie dor-

mant on the fuzz or seed coat of the cottonseed. In either case they are in a suitable position to commence infections in the young seedlings after the seed are planted the following spring. If the spring weather is favorable for the development of these parasites, particularly if it is damp and cool, the seedlings are attacked and they fail to emerge or die soon after emergence. The grower who is familiar with the "seedling blight" or "damping-off" may attribute it directly to the weather, although actually it is due to cotton disease organisms favored by the weather. The harmful effects of seedling blight are two-fold. The stand may be so poor that replanting is necessary, or if some of the seedlings survive they may be permanently injured and they will also provide a breeding-place for the later development of the disease organisms, thus contributing to the leaf and boll diseases of the mature plant.

In efforts to eliminate seedling blight and the subsequent effects of cotton diseases, plant pathologists have devised a number of methods of seed treatment designed to destroy the organisms on the seed and to protect the seedlings in the soil. Among these treatments, those which have met with the most success are dusting the seed with an organic mercury dust such as "Ceresan," and delinting the seed with concentrated sulphuric acid or hydrochloric acid gas. The delinting may or may not be followed by dusting, grading, or dipping in liquid disinfectants.

WHICH IS THE BETTER TREATMENT, DUSTING OR DELINTING THE SEED? Each method has advantages not pertaining to the other method. The advantages of both methods may be combined at an additional cost of about 2 cents per acre by dusting the seed after delinting it. Dusting the seed with "Ceresan" is in more general use than any other cottonseed treatment at the present time. "Ceresan" depends for its action on a poisonous vapor which is slowly liberated when dusted seed is exposed to soil moisture. Its action is two-fold: it destroys the disease organisms on the seed surface and fuzz, and it surrounds the planted seed with a persistent wall of fungicidal vapor which helps to protect the sprouting seed from parasitic fungi and bacteria in the soil. The treated seed begins to deteriorate only after several months of storage. The operator must be protected from the poisonous dust during the treatment, and farm animals must be protected from any possibility of eating the poison. The chemical for treatment costs approximately 6 cents per bushel, which is considerably cheaper than the acid used in delinting, and furthermore the dust is applied more easily and quickly than the acid.

Acid delinting has the advantages of hastening germination and facilitating grading of the seed. Acid-treated seed do not carry a protective coating into the soil unless they are also dusted, but the dusting is greatly simplified by preliminary delinting. Acid-delinted seed shows its quality plainly, and the treatment is an aid to the seed buyer in estimating the quality of seed. Acid-delinted seed may be planted with a corn plate at a much lower seeding rate than dusted or undusted fuzzy seed, which means that a bushel of seed after delinting will plant twice as great an acreage as the same seed before delinting.

The two treatments are equally effective in destroying disease organisms on the seed surface. The seed may be mechanically delinted by reginning, in which case there is a substantial saving of either dust or acid. The reginning does not add to the grower's cost because the linters pay for the cost of the operation.

Unless use is made of a central custom delinting plant, the acid treatment is likely to be impractical for most cotton growers, and the dust treatment will probably be most popular in the Southwest. Many Oklahoma and Texas cotton growers have already adopted the practice of seed-dusting, and it is a common experience to find the better quality cottonseed in the market under a "Ceresan" label.

How is the dust treatment accomplished? The materials most commonly used in cottonseed treatment are 2 percent "Ceresan" (ethyl mercury chloride) and "New Improved Ceresan" (ethyl mercury phosphate). Other chemical dusts, for example, red copper oxide, have been suggested or recommended for cottonseed treatments, but none of these has as yet been adopted on a wide scale. The chloride is used at the rate of 3 ounces per bushel of seed, the phosphate at 1½ ounces per bushel. While the chloride has been most generally used in the past, a recent report by the Cotton Disease Council of the American Phytopathological Society, based on extensive tests in many states, favors the phosphate or "New Improved Ceresan" as being superior in its action and cheaper. The phosphate retails at 65 cents per pound in 5-pound lots, which makes the cost of the chemical approximately 6 cents per bushel of seed or about 4 cents per acre.

Power treaters are available for the treatment of large quantities of seed, as might be done in connection with the operation of a gin. It is desirable to dust acid-delinted seed, and for such seed the commercial or gravity-type home-made cereal seed dusters are suitable. But fuzzy cottonseed cannot be

effectively treated with the gravity dusters, in general use for cereal seed, and the grower is obliged to use the home-made revolving-barrel type of treater.

In operation, one bushel of fuzzy seed is placed in the treater, the required amount of dust is added, and the barrel is slowly turned for five minutes. *These organic mercury dusts are poisonous* if eaten or inhalted in large quantities. The operator should work outdoors, on the windward side of the equipment, and should protect his nose and mouth with a dry-filter mask or pad of folded gauze. Treated seed should be marked with a "Poison" label and stored out of reach of livestock. The treated seed may be stored as long as seven months without deterioration.

How is the acid treatment accomplished? If fuzzy cottonseed are treated with concentrated sulphuric acid for a few minutes, the acid dissolves away the lint, leaving the seed as smooth as seed corn. At the same time, the acid softens the seed coat, without injury to the seed, so that such seed can more rapidly absorb moisture from the soil, and hence germinate in a shorter time than untreated seed. Moreover, the acid is a powerful disinfectant, and any disease organisms which are on the surface of the seed are killed by the treatment.

For delinting limited amounts of seed, simple home-made equipment can be used. A large, water-tight barrel is cut in two to form two tubs. In the bottom of one tub are bored a large number of one-inch holes, and the bottom is then lined with 18-inch hardware gauze which is tacked in place. A long-handled wooden paddle is necessary. The perforated tub is set astride a ditch or pit for disposal of the acid, near to an ample supply of water.

Concentrated commercial sulphuric (66° Baume) is used at the rate of one-half gallon per bushel of fuzzy seed. If gin-delinted seed is being treated, half of this amount of acid will suffice. According to recommendations of the Mississippi Experiment Station, poorer grades of acid may be used, such as those used by fertilizer companies in manufacturing acid phosphate, but in this case the amount of acid required may be almost twice as great as with the concentrated acid. In delinting cottonseed by the hydrochloric acid gas method strong acid is produced as a waste product, and this merits trial for decreasing the expense of delinting by combining the gas and acid treatments in tandem, and at the same time helping to dispose of an often objectionable waste product.

For the acid treatment, one bushel of fuzzy seed is placed in the solid tub and the acid poured in. The seed are stirred for

about five minutes or until the lint has entirely disappeared and the seed have formed a black, sticky mass. The tub is then filled with water, quickly to avoid excessive heating, and the contents poured into the perforated tub. More water is poured over the seed, to wash away the acid, until the wash-water no longer has a sour taste. A large volume of water is required for the washing. Under conditions in which the water is limited or disposal of waste is a problem, it might be advisable to follow the Tennessee suggestion of washing the seed once with water, and then neutralizing the remainder of the acid with lime.

Delinting cottonseed with hydrochloric acid gas has been carried out on a custom basis in central delinting plants in the Southwest. The treatment is effective in destroying disease organisms on the surfaces of seeds and has the advantage of being a dry method of treatment. No experiment station data on the posibility of seed injury by the method are available. No home method of applying hydrochloric acid gas to cottonseed is in general use.

SHOULD COTTONSEED BE GRADED? Just as in the case of other types of agricultural seed, grading is a material aid in improving cotton stands and yields. Ordinary planting seed often contains many light seeds. While some of these are immature, others are internally diseased and serve to introduce disease organisms into the field. Grading is not as easy and efficient with ordinary fuzzy seed as with gin- or acid-delinted seed, but there are cottonseed cleaners or graders on the market which will materially improve the quality of the seed.

Acid-delinted seed may be cleaned and graded by any of several methods, fanning, screening, or floating, as readily as in the case of cereal seed, where cleaning and grading are standard practices in crop improvement and disease control. Since acid-delinted seed are suspended in water during the washing process, it is comparatively easy, at that stage, to skim off the fraction which float. This is an efficient method of removing the diseased, injured, and immature seed, and gives the quality of the finest graded seed without the labor of an additional cleaning process.

The floating seed fraction, which contains the diseased and immature seed, is unfit for planting, but may be sold for oil processing at the market price for prime seed, according to quotations on file. The sinking seed, which usually constitute about two-thirds of the total seed, often show germination of 95-100 percent in the laboratory and sometimes higher than 80 percent in the field.

Tests at the Oklahoma Agricultural Experiment Station have shown that these heavy seed may be planted at a seeding rate of only 40 percent that usually used, and produce stands which require no thinning and crops which considerably outyield those from fuzzy or ungraded seed which were planted at a seeding rate 2½ times greater and then chopped. In an average of all experiments in 1938 and 1939 the heavy fraction of delinted seed outyielded the fuzzy seed by 40 percent of seed cotton and outyielded the delinted but ungraded seed by 10 percent. The reduced planting rate and the selling of the light seed for oil processing give a return which more than pays for the cost of the treatment, so that the disease control and increased yields are cost-free.

A PLAN FOR THIS YEAR. The planting date is almost here, but there is still time to undertake a trial of cottonseed treatment. Why not try one of the treatments on a few acres? The investment is nominal; a few cents an acre. There is good reason to believe that this investment may be repaid many times in a saving of seed and in improved stands and yields. It would be a good plan to leave part of the cotton acreage untreated, and weigh the seed cotton from the treated and untreated acres separately, to get reliable results on the value of the treatment. The seasonal weather conditions will determine to some extent the benefit of the treatment, which is most helpful in the years when planting is followed by cold, wet weather. The writer will be glad to answer your further questions on cottonseed treatments and the prevention of cotton diseases. This service is a part of the duties of the Agricultural Experiment Station, and you may feel free to make use of it.